RTT TECHNOLOGY TOPIC
May 2000

The 3G PC

The first generation PC was the desktop.

The second generation PC was the lap top.

The 2.5G PC was the network computer ('the network is the computer'). This failed due to lack of memory bandwidth in the appliance (the thin client) and a lack of network delivery bandwidth during critical access periods (the 9.00 am boot storm).

The 3G PC is a fat client – so fat that for most of the time it acts as a server firing into the network. Note that appliance memory bandwidth delivers user experience transparency regardless of whether the device is connected to a wireline or wireless termination.

The 3G PC is the consequence of six industries converging – computer, consumer electronics, IT, wireless, wireline and TV – with the Internet as the point of intersection.

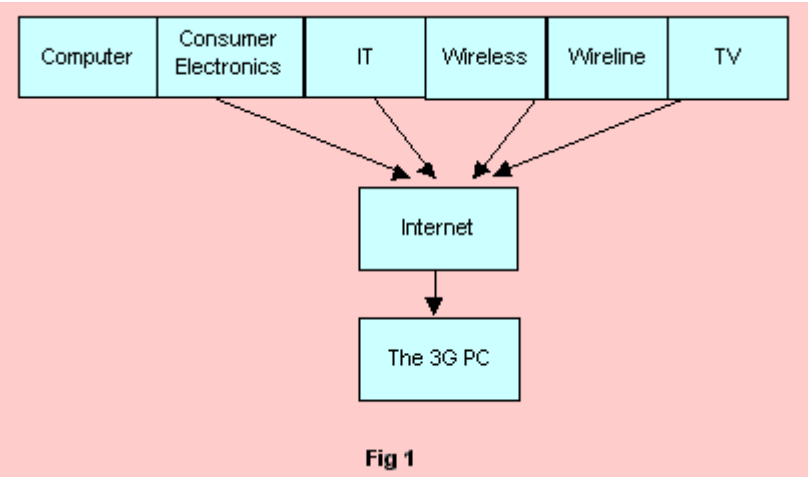

Fig 1

This Hot Topic profiles the likely form factor and functionality of the 3G PC and it's relationship with 3G wireless and wireline internet networks.

A Creative Appliance

In previous HOT TOPICS we defined how we capture 'complex content' at the edge of the wireless (or wireline) network – we characterized 'complex content' as a mix of voice/audio, image, video and application streaming, we showed how 'content capture platforms' – CMOS imaging and MP4 editing and encoding - create value in the user's appliance, how this means that our view of the end user as a consumer is probably wrong – in an egocentric value model, the user creates before he

consumes, sends before he receives – uplink edge inwards value not network centric edge outwards value. This in turn determines edge device hardware and software design. The input appliance (formerly the phone) is an information creation platform – a 'creative appliance' rather than a 'consumer appliance'. Consumer appliances are passive devices – their value goes down over time (we get bored with consuming). Creative appliances are active devices, their value increases over time (creativity adds value). Creative appliances will form the basis of a new industry – the creative electronics industry which will take value away from the (obsolete) consumer electronics industry. A dominant form factor and functionality will emerge over time to fill the 'creative appliance' product space – this in effect will be the next generation PC. (3G PC)

Hardware/Software Form Factor

This leads us to define a standardised form factor for a 3G 'creative appliance' – an intelligent embedded MP4 based operating system which is network aware, capable of negotiating highly specific QoS access parametrics, an RF platform capable of carrying highly variable rate data across a consistent low error rate channel in a wide area mobility environment, an infrared and/or RF platform for high bit rate local access connectivity and a DSL or VDSL modem for wireline connectivity, a CMOS imaging platform and a 1:1, 4:3 or 16:9 high resolution colour display, a comfortable keyboard to type on (for e-mail and application control) and a smart card to define content ownership rights, access rights and QoS parameters – 'the computer is the network'.

3G PC Hardware

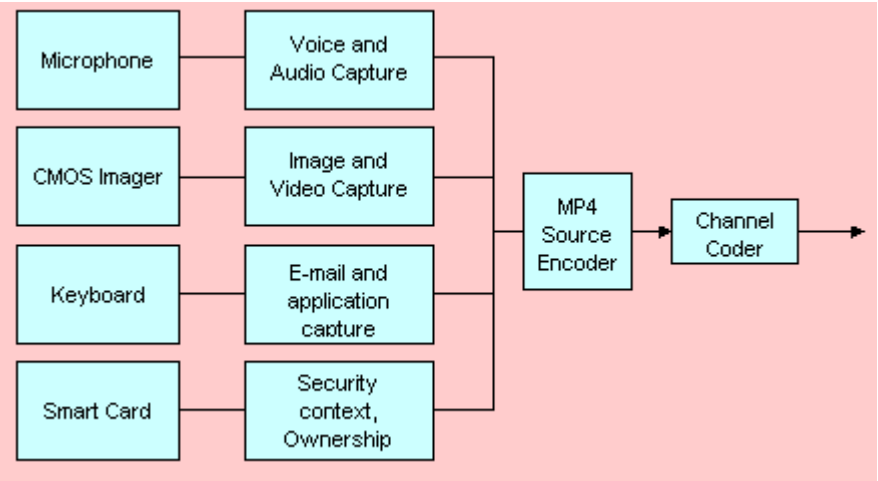

Fig 2

The job of the MP4 encoder is to process audio, images, video, e-mail and applications from the microphone, CMOS imager and keyboard together with security context, authorisation, proof of provenance (proof of content ownership) and QoS parameters from the smart card (SIM/USIM).

3G PC Software

The standardised hardware footprint will use standardised software (Doors 2010 – the open door standard).

The embedded application O/S will manage each of the 4 input information streams for presentation to the MP4 compression engine (source encoder).

The output from the coder will be one or more variable bit streams which contain compressed versions of the original input information. Note: you may have to encrypt **after** compression to maintain compression efficiency.

3G PC Connectivity

The creative appliance needs local area **and** wide area connectivity – the connectivity needs to preserve the integrity and value of complex content delivered into and out of the network.

This implies that we need to determine a methodology by which we can quantify 'content value'. Content value is in practice a product of content complexity – in effect, information density but using defined quality parameters – audio fidelity, image and video resolution, contrast and colour depth, application latency and integrity. If we compromise content quality we compromise content value – analogous to damaging a painting sent by post.

The variable rate bit stream (or bit streams if separately multiplexed in the MP4 encoder) have various quality of service requirements which need to be defined and possibly re-defined as the session proceeds. Note that a session might typically start as a simplex (one way) send. If the receiver responds, the session becomes interactive and QoS requirements such as end to end delay and jitter (delay variability) become substantially more important. There may also be a security and ownership context associated with the session and various other functional parameters – server queue priority for example. Note that the session will probably require access to parallel web content (locally stored in the appliance).

The QoS parameters effectively form the basis of a session specific service level agreement which establishes maximum and minimum throughput and latency jitter and defines any changes that need to be made to the content - for example re-sizing 4:3 images to fit into a 16:9 display form factor or matching latency parameters to memory buffer constraints.

This implies that the application needs to be network aware, ie have knowledge of available network resources in terms of memory and delivery bandwidth and bandwidth quality parameters.

It is the embedded O/S of the creative appliance that needs to perform this function – note the functional commonality across a number of access platforms – set top box, ADSL/VDSL modem or wireless device.

The challenge for wireless (infrared or RF local connectivity or RF wide area

connectivity) is to provide an end user experience at least as consistent as a wireline access termination. It will be hard to achieve this with existing 2G air interface and network topologies due to air interface and network bandwidth **quality** limitations.

It is generally considered that RF wireless access is bandwidth constrained when compared to wireline copper access. This is untrue. Propagation loss in copper beyond 1 GHz becomes unacceptably high (effectively unusable in existing local loops). RF wireless access has access to virtually unlimited bandwidth. The problem with RF access is that it is power limited (regulatory and battery bandwidth constraints) and has dynamic range limitations. We examine this in more detail in our next Hot Topic – 2G Connectivity Constraints.

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